

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference TS 1311 PCT	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416																
International application No. PCT/EP2004/050347	International filing date (day/month/year) 23.03.2004	Priority date (day/month/year) 25.03.2003																	
International Patent Classification (IPC) or national classification and IPC C10J3/30, C10J3/56, C10J3/50, B01J8/00																			
Applicant SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.																			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 8 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> <i>(sent to the applicant and to the International Bureau)</i> a total of 6 sheets, as follows:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</li> <li><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the International application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</li> </ul> <p>b. <input type="checkbox"/> <i>(sent to the International Bureau only)</i> a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>																			
<p>4. This report contains indications relating to the following items:</p> <table border="0"> <tr> <td><input checked="" type="checkbox"/> Box No. I</td> <td>Basis of the opinion</td> </tr> <tr> <td><input type="checkbox"/> Box No. II</td> <td>Priority</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/> Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/> Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/> Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>				<input checked="" type="checkbox"/> Box No. I	Basis of the opinion	<input type="checkbox"/> Box No. II	Priority	<input checked="" type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/> Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/> Box No. VI	Certain documents cited	<input type="checkbox"/> Box No. VII	Certain defects in the international application	<input checked="" type="checkbox"/> Box No. VIII	Certain observations on the international application
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Date of submission of the demand  22.12.2004	Date of completion of this report  01.09.2005																		
Name and mailing address of the international preliminary examining authority:   European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer  Lapeyrere, J Telephone No. +31 70 340-2333																		



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2004/050347

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
  - This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
    - international search (under Rules 12.3 and 23.1(b))
    - publication of the international application (under Rule 12.4)
    - international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

**Description, Pages**

2-19 as originally filed  
1, 1a received on 24.01.2005 with letter of 24.01.2005

**Claims, Numbers**

1-17 received on 24.01.2005 with letter of 24.01.2005

**Drawings, Sheets**

1/6-6/6 as originally filed

- a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
- 3.  The amendments have resulted in the cancellation of:
  - the description, pages
  - the claims, Nos.
  - the drawings, sheets/figs
  - the sequence listing (*specify*):
  - any table(s) related to sequence listing (*specify*):
- 4.  This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
  - the description, pages
  - the claims, Nos.
  - the drawings, sheets/figs
  - the sequence listing (*specify*):
  - any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:
  - the entire international application,
  - claims Nos. 3, 4, 10
    - because:
    - the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):
    - the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 3, 4, 10 are so unclear that no meaningful opinion could be formed (specify):  
**see separate sheet**
    - the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
    - no international search report has been established for the said claims Nos.
    - the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form	<input type="checkbox"/> has not been furnished
	<input type="checkbox"/> does not comply with the standard
the computer readable form	<input type="checkbox"/> has not been furnished
	<input type="checkbox"/> does not comply with the standard
    - the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-bis of the Administrative Instructions.
    - See separate sheet for further details

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes:	Claims 2, 6, 15-17
	No:	Claims 1, 5, 7-9, 11-14
Inventive step (IS)	Yes:	Claims
	No:	Claims 1, 2, 5-9, 11-17
Industrial applicability (IA)	Yes:	Claims 1-17
	No:	Claims

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**WRITTEN OPINION OF THE INTERNATIONAL  
PRELIMINARY EXAMINING AUTHORITY  
(SEPARATE SHEET)**

International application No.

PCT/EP2004/050347

**Re Item I**

**Basis of the report**

1. Amendment brought by applicant in his letter dated 24/01/2005 are considered as fulfilling the requirements of rule 70.1 PCT.

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The document D3 was not cited in the international search report. Copies of the documents are appended hereto.

D3 : LU43908

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1, 9 and 15 is not new in the sense of Article 33(2) PCT.
3. The document D3 discloses (the references in parentheses applying to this document):  
a hopper vessel (11) for temporarily holding a load of solid particulates, having a receiver part with a downwardly converging wall (see figure 3) that is at an apex thereof provided with a discharge port (34) for discharging the load, which receiver part is provided with an aerator (22) for aerating the load, the aerator comprising a supply passage in the form of a tubular member (22) connectable to a supply (21) of a pressurised aeration fluid or pressurising fluid whereby the pressurized aeration fluid or pressurising fluid is transportable through the supply passage (22), whereby the tubular member comprises a side wall that is provided with one or more openings (23) perforating the tubular member side wall, for allowing passage of the pressurized aeration fluid or the pressurising fluid from the supply passage into the hopper vessel, which tubular member is positioned on or close to the converging wall (see figure 3).
4. Passages on page 3, first paragraph and fourth paragraph are considered relevant for what concerns novelty and inventive activity of the application.

**Dependent claims 5 to 8**

**WRITTEN OPINION OF THE INTERNATIONAL  
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(SEPARATE SHEET)**

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5. Dependent claims 5, 7, 8 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty because their subject-matter is disclosed in document D3.
6. Dependent claims 6 does not contain any features which, in combination with the features of any claim to which it refers, meet the requirements of the PCT in respect of inventive step because their subject-matter is disclosed in document D1 or D2.

**Independent claim 9**

7. The document D3 discloses (the references in parentheses applying to this document):  
a sluice vessel (11) for feeding solid particulates into a pressurized pressure vessel, the sluice vessel (...) the sluice vessel comprising means (14) for charging the sluice vessel (11) with a load of the solid particulates (...) at least one discharge port (34), and pressurising means (21, 22, 24) for increasing the pressure inside the sluice vessel (...) whereby the pressurising means comprises one or more pressurising fluid inlet means (22) (...) the pressurising fluid inlet means (22) comprising a supply passage in the form of a tubular member (22) for transporting the pressurising fluid whereby the tubular member comprises a side wall that is provided with one or more openings (23) perforating the tubular member side wall, for allowing passage of the pressurising fluid from the supply passage into the sluice vessel (11).

**Dependent claims 11 to 14**

8. Dependent claims 12 to 14 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty because their subject-matter has been described in document D3.
9. Dependent claim 11 does not contain any features which, in combination with the features of any claim to which it refers, meet the requirements of the PCT in respect of novelty because their subject-matter has been described in documents D1 or D2.

**Independent claim 15**

10. The document D1 is regarded as being the closest prior art to the subject-matter of claim 15, and discloses (the references in parentheses applying to this document):  
a method of operating a sluice vessel for feeding solid particulates into a

pressurised pressure vessel, the sluice vessel comprising at least one discharge port, wherein the sluice vessel is brought from a low pressure state to a high pressure state, comprising the steps of:

charging the sluice vessel with a load of the solid particulates when the sluice is in its low pressure state;

bringing the sluice vessel into its high pressure state, before discharging the load via the discharge port, by bringing a pressurising fluid into the sluice vessel thereby increasing the pressure inside the sluice vessel;

at least part of the pressurising fluid is brought into the sluice vessel via one or more pressurising fluid inlet means submerged under the load of solid particulates.

The subject-matter of claim 15 therefore differs from this known method in that fluid inlet means are provided as one or more openings perforating a tubular member side wall. The problem to be solved by the present invention may therefore be regarded as finding an alternative gas feeding means.

11. The solution proposed in claim 15 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) because document D3 discloses in page 3, paragraph 4 that various embodiments are possible for the injection of gas: porous tube but also openings perforating a tubular member. Therefore this feature is merely one of several straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed.

**Dependent claims 16 and 17**

12. Dependent claims 16 and 17 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive activity because their subject-matter is disclosed in document D1 in combination with document D3.

**Re Item VIII**

**Certain observations on the international application**

13. As explained below, some of the features in the apparatus claim 9 relate to a method of using the apparatus rather than clearly defining the apparatus in terms of its technical

**WRITTEN OPINION OF THE INTERNATIONAL  
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(SEPARATE SHEET)**

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features. The intended limitations are therefore not clear from this claim, contrary to the requirements of Article 6 PCT.

The process features are :

- **in use having a low pressure state and a high pressure state,**
- **when the sluice vessel is in its low pressure state,**
- **by bringing a pressurising fluid into the sluice vessel, to bring the sluice vessel into its high pressure state before discharging the load via the discharge port,**
- **arranged to be submerged under the load of solid particulates,**

14. Claim 3 is not clear since "the tubular member is positioned on or close to the converging wall" in claim 1. Therefore it is already "off-vertical" and feature of claim 3 is already in claim 1.
15. Moreover the feature "off-vertical" in claim 3 and 10 is a process feature describing how the apparatus is used and not a definition of the apparatus in terms of its technical features. The intended limitations are therefore not clear from this claim, contrary to the requirements of Article 6 PCT.  
Same objection is raised for the term "upward direction" in claim 4 and 10. Said term is also a process feature of the apparatus.

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## SLUICE VESSEL AND METHOD OF OPERATING SUCH A SLUICE VESSEL

The present invention relates to a sluice vessel for feeding solid particulates into a pressurized pressure vessel. More generally, the present invention relates to a hopper vessel for temporarily holding a load of solid particulates. The hopper vessel can be of any type, including a sluice vessel or a feed hopper. Such a sluice vessel may be used in a gasification plant, wherein a pulverised carbonaceous fuel, such as coal, is transformed into synthesis gas.

Such a gasification plant can comprise an atmospheric powder coal storage vessel, a sluice vessel, a pressurized powder coal storage vessel, and a gasification reactor. In operation, the powder coal is charged from the powder coal storage vessel into the sluice vessel at atmospheric pressure. Then the sluice vessel is closed and pressurised.

After the pressure in the sluice vessel is essentially equal to or somewhat higher than that in the pressurized powder coal storage vessel, the load of powder coal is charged into the pressurized powder coal storage vessel. Hence, the pressurized powder coal storage vessel is supplied with powder coal load by load in a batch wise manner.

To facilitate a continuous flow of powder coal from the pressurized powder coal storage vessel to the gasification reactor, the pressure in the pressurized powder coal storage vessel is desirably higher than the operating pressure inside the gasification reactor. Thus, a continuous supply of powder coal from the pressurized powder coal storage vessel to the gasification reactor is feasible, provided that the batch loading of the

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pressurized powder coal storage vessel occurs at  
sufficiently high repetition rate to

C L A I M S

1. Hopper vessel for temporarily holding a load of solid particulates, having a receiver part with a downwardly converging wall that is at an apex thereof provided with a discharge port for discharging the load, which receiver part is provided with an aerator for aerating the load, the aerator comprising a supply passage in the form of a tubular member connectable to a supply of a pressurised aeration fluid or pressurising fluid whereby the pressurized aeration fluid or pressurising fluid is transportable through the supply passage, whereby the tubular member comprises a side wall that is provided with one or more openings perforating the tubular member side wall, for allowing passage of the pressurized aeration fluid or the pressurising fluid from the supply passage into the hopper vessel, which tubular member is positioned on or close to the converging wall.  
5
10. 2. Hopper vessel according to claim 1, wherein the supply passage is connectable to a pressurisation device.
15. 3. Hopper vessel according to claim 1 or 2, wherein the tubular member extends in a substantially off-vertical direction.
20. 4. Hopper vessel according to claim 3, wherein the one or more openings in the supply passage side wall face an upward direction.
25. 5. Hopper vessel according to claim 1, 2, 3, or 4, wherein the tubular supply passage extends along a longitudinal tube axis, and the discharge port is in alignment with the longitudinal tube axis.
30. 6. Hopper vessel according to any one of the previous claims, wherein the one or more openings are provided with a distributor comprising a porous material,

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preferably made of a sintered metal, for supporting the solid particulates and allowing passage of pressurized aeration fluid or the pressurising fluid.

5 7. Hopper vessel according to any one of the previous claims, wherein there is a discharge zone defined inside the hopper vessel which discharge zone stretches vertically above the discharge port, whereby the supply passage is provided outside the discharge zone.

10 8. Hopper vessel according to any one of the previous claims, wherein the one or more openings are arranged to bring pressurized aeration fluid or the pressurising fluid into the hopper vessel in a direction facing away from the converging wall.

15 9. Sluice vessel for feeding solid particulates into a pressurized pressure vessel, the sluice vessel in use having a low pressure state and a high pressure state, the sluice vessel comprising means for charging the sluice vessel with a load of the solid particulates when the sluice vessel is in its low pressure state, at least 20 one discharge port, and pressurising means for increasing the pressure inside the sluice vessel by bringing a pressurising fluid into the sluice vessel, to bring the sluice vessel into its high pressure state before discharging the load via the discharge port, whereby the 25 pressurising means comprises one or more pressurising fluid inlet means arranged to be submerged under the load of solid particulates, the pressurising fluid inlet means comprising a supply passage in the form of a tubular member for transporting the pressurising fluid whereby the tubular member comprises a side wall that is provided with one or more openings perforating the tubular member side wall, for allowing passage of the pressurising fluid from the supply passage into the sluice vessel.

30 10. Sluice vessel according to claim 9, wherein the tubular member extends in a substantially off-vertical

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direction whereby the one or more openings face an upward direction.

11. Sluice vessel according to claims 9 or 10, wherein the one or more openings are provided with a distributor comprising a porous material, preferably made of a sintered metal, for supporting the solid particulates and allowing passage of the pressurising fluid, which distributor is mechanically supported by the supply passage for withstanding a pressure difference across the distributor corresponding to at least the pressure difference between the low pressure state and a high pressure state.

10 12. Sluice vessel according to any one of claims 9 to 11, wherein there is a discharge zone defined inside the sluice vessel which discharge zone stretches vertically above the discharge port, whereby the supply passage is provided outside the discharge zone.

15 13. Sluice vessel according to claim 10, 11 or 12, having a part with a downwardly converging wall forming at an apex thereof the at least one discharge port, wherein the pressurising fluid inlet means are arranged in, on, or close to the converging wall.

20 14. Sluice vessel according to claim 13, wherein the pressurising fluid inlet means are arranged to bring the pressurising fluid into the sluice vessel in a direction facing away from the converging wall.

25 15. Method of operating a sluice vessel for feeding solid particulates into a pressurised pressure vessel, the sluice vessel comprising at least one discharge port, wherein the sluice vessel is brought from a low pressure state to a high pressure state, comprising the steps of:

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charging the sluice vessel with a load of the solid particulates when the sluice is in its low pressure state;

5 bringing the sluice vessel into its high pressure state, before discharging the load via the discharge port, by bringing a pressurising fluid into the sluice vessel thereby increasing the pressure inside the sluice vessel;

10 whereby at least part of the pressurising fluid is brought into the sluice vessel via one or more pressurising fluid inlet means provided as one or more openings perforating a tubular member side wall submerged under the load of solid particulates.

15 16. Method according to claim 15, further comprising the step of discharging the load via the discharge port, while aerating the load by allowing a flow of an aeration fluid through the one or more pressurising fluid inlet means.

20 17. Method according to claim 16, wherein the aeration fluid is actively injected into the load of the solid particulates, whereby preferably one or both of a selected pressure and a selected volumetric rate of the aeration fluid is controlled.